

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (currently amended) A gas sensor abnormality detecting device made to detect the presence or absence of abnormality of a gas sensor having a cell in which a pair of electrodes are formed on a solid electrolyte material to output a signal corresponding to a composition of a measured gas on surfaces of said electrodes through a signal line connected to said electrodes, said device comprising:

signal inputting ~~means~~ processing mechanism for temporarily inputting a test signal including an alternating-current component through said signal line to said cell undergoing abnormality detection, said alternating-current component being above 1 kHz;

response signal ~~detecting means~~ detector for detecting a response signal developing in said signal line in response to the inputting of said test signal; and

decision ~~means~~ processing mechanism for comparing a detection value of said response signal with a prescribed value and, if said detection value resides in one of regions defined by said prescribed value, making a decision that a disconnection abnormality occurs in said cell undergoing the abnormality detection.

2. (currently amended) A gas sensor abnormality detecting device made to detect the presence or absence of abnormality of a gas sensor having a cell in which a pair of electrodes are formed on a solid electrolyte material to output a signal corresponding to a composition of a measured gas on surfaces of said electrodes through a signal line connected to said electrodes, said device comprising:

signal inputting processing mechanism for temporarily inputting a test signal including an alternating-current component through said signal line to said cell undergoing abnormality detection;

response signal detector for detecting a response signal developing in said signal line in response to the inputting of said test signal; and

decision processing mechanism for comparing a detection value of said response signal with a prescribed value and, if said detection value resides in one of regions defined by said prescribed value, making a decision that a disconnection abnormality occurs in said cell undergoing the abnormality detection;

~~The device according to claim 1,~~ wherein, for the detection of said response signal, a predetermined time delay is set with respect to said test signal.

3. (currently amended) A gas sensor abnormality detecting device made to detect the presence or absence of abnormality of a gas sensor

composed of a plurality of cells each having a pair of electrodes formed on a solid electrolyte material to output a gas detection signal corresponding to a composition of a measured gas at surfaces of said electrodes through a signal line connected to the electrodes and made such that one electrodes of said pairs of electrodes of said plurality of cells are placed to confront a common chamber, said device comprising:

test signal inputting ~~means~~processing mechanism for temporarily inputting a test signal including an alternating-current component through the signal lines to a specified cell of said plurality of cells, said alternating-current component being above 1 kHz;

response signal ~~detecting means~~detector for, in response to the inputting of said test signal, detecting a response signal developing in said signal line for a cell, undergoing abnormality detection, other than said specified cell; and

decision ~~means~~processing mechanism for comparing a detection value of said response signal with a prescribed value and, if said detection value resides in preset one of regions defined by said prescribed value, making a decision that a disconnection abnormality occurs in said cell undergoing the abnormality detection.

4. (currently amended) A gas sensor abnormality detecting device made to detect the presence or absence of abnormality of a gas sensor

composed of a plurality of cells each having a pair of electrodes formed on a solid electrolyte material to output a gas detection signal corresponding to a composition of a measured gas at surfaces of said electrodes through a signal line connected to the electrodes and made such that one electrodes of said pairs of electrodes of said plurality of cells are placed to confront a common chamber, said device comprising:

test signal inputting processing mechanism for temporarily inputting a test signal including an alternating-current component through the signal lines to a specified cell of said plurality of cells;

response signal detector for, in response to the inputting of said test signal, detecting a response signal developing in said signal line for a cell, undergoing abnormality detection, other than said specified cell;

decision processing mechanism for comparing a detection value of said response signal with a prescribed value and, if said detection value resides in preset one of regions defined by said prescribed value, making a decision that a disconnection abnormality occurs in said cell undergoing the abnormality detection; and

~~The device according to claim 3, further comprising~~ second response signal ~~detecting means~~ detector for, in response to said test signal with respect to said specified cell, detecting a response signal developing in a signal line for said specified cell; and

second decision ~~means~~ processing mechanism for comparing a detection value of said response signal with a prescribed value to, if the detection value resides in preset one of the regions defined by said prescribed value, make a decision that a disconnection abnormality occurs in said specified cell.

5. (currently amended) The device according to claim 4, further comprising:

response signal ~~detecting means~~ detector for, in response to the inputting of said test signal to said specified cell, detecting a response signal developing in a signal line for the specified cell;

impedance ~~calculating means~~ calculator for obtaining an impedance between said electrodes of said specified cell on the basis of said test signal and said response signal; and

heater ~~control means~~ controller for controlling a heater integrated with gas sensor together with the cell on the basis of the obtained impedance.

6. (currently amended) A gas sensor abnormality detecting device made to detect the presence or absence of abnormality of a gas sensor having a cell in which a pair of electrodes are formed on a solid electrolyte material to output a signal corresponding to a composition of a measured gas on

surfaces of said electrodes through a signal line connected to said electrodes, said device comprising:

signal inputting processing mechanism for temporarily inputting a test signal including an alternating-current component through said signal line to said cell undergoing abnormality detection;

response signal detector for detecting a response signal developing in said signal line in response to the inputting of said test signal;

decision processing mechanism for comparing a detection value of said response signal with a prescribed value and, if said detection value resides in one of regions defined by said prescribed value, making a decision that a disconnection abnormality occurs in said cell undergoing the abnormality detection;

~~The device according to claim 1, further comprising:~~

~~temperature state detecting means~~detector for detecting a temperature state of said solid electrolyte material; and

~~inhibiting means~~processing mechanism for inhibiting the abnormality decision processing in said decision ~~means~~processing mechanism until said temperature state reaches a predetermined temperature region of said solid electrolyte material.

7. (currently amended) The device according to claim 6, wherein said temperature state ~~detecting means~~ detector obtains an impedance between said electrodes on the basis of said test signal and said response signal, with said impedance being used as a parameter for said temperature state.

8. (currently amended) A gas sensor abnormality detecting device made to detect the presence or absence of abnormality of a gas sensor having a cell in which a pair of electrodes are formed on a solid electrolyte material to output a signal corresponding to a composition of a measured gas on surfaces of said electrodes through a signal line connected to said electrodes, said device comprising:

signal inputting processing mechanism for temporarily inputting a test signal including an alternating-current component through said signal line to said cell undergoing abnormality detection;

response signal detector for detecting a response signal developing in said signal line in response to the inputting of said test signal; and

decision processing mechanism for comparing a detection value of said response signal with a prescribed value and, if said detection value resides in one of regions defined by said prescribed value, making a decision that a disconnection abnormality occurs in said cell undergoing the abnormality detection;

~~The device according to claim 1,~~ wherein said test signal inputting means processing mechanism inputs a temporary voltage variation as said test signal to said signal line, and said response signal ~~detecting means~~ detector detects a variation of a current flowing through said signal line as said response signal, and said decision ~~means~~ processing mechanism sets, as said one region, a smaller region than said prescribed value and, when said detection value falls below said prescribed value, makes a decision that a disconnection abnormality occurs in said cell undergoing the abnormality detection.

9. (currently amended) A gas sensor abnormality detecting device made to detect the presence or absence of abnormality of a gas sensor having a cell in which a pair of electrodes are formed on a solid electrolyte material to output a signal corresponding to a composition of a measured gas on surfaces of said electrodes through a signal line connected to said electrodes, said device comprising:

signal inputting processing mechanism for temporarily inputting a test signal including an alternating-current component through said signal line to said cell undergoing abnormality detection;

response signal detector for detecting a response signal developing in said signal line in response to the inputting of said test signal; and

decision processing mechanism for comparing a detection value of said response signal with a prescribed value and, if said detection value resides in one of regions defined by said prescribed value, making a decision that a disconnection abnormality occurs in said cell undergoing the abnormality detection;

~~The device according to claim 1,~~ wherein said test signal inputting ~~means~~ processing mechanism inputs a temporary current variation as said test signal to said signal line, and said response signal ~~detecting means~~ detector detects a variation of a voltage in said signal line as said response signal, and said decision ~~means~~ processing mechanism sets, as the one region, a larger region than said prescribed value and, when said detection value exceeds said prescribed value, makes a decision that a disconnection abnormality occurs in said cell undergoing the abnormality detection.

10. (currently amended) A gas sensor abnormality detecting device made to detect the presence or absence of abnormality of a gas sensor composed of a cell having a pair of electrodes formed on a solid electrolyte material to output a gas detection signal corresponding to a composition of a measured gas on surfaces of said electrodes through a signal line connected to said electrodes, said device comprising:

test signal inputting ~~means~~processing mechanism for temporarily inputting a test signal including an alternating-current component through said signal line with respect to a cell undergoing abnormality detection, said alternating-current being above 1 kHz;

response signal ~~detecting means~~detector for, in response to the inputting of said test signal, detecting a response signal developing in said signal line;

impedance ~~ealeulating means~~calculator for obtaining an impedance between said electrodes on the basis of said test signal and said response signal; and

decision ~~means~~processing mechanism for comparing the obtained impedance value with a prescribed value and, if the obtained impedance value exceeds said prescribed value, making a decision that a disconnection abnormality occurs in said undergoing abnormality detection.

11. (currently amended) A gas sensor abnormality detecting device made to detect the presence or absence of abnormality of a gas sensor composed of a cell having a pair of electrodes formed on a solid electrolyte material to output a gas detection signal corresponding to a composition of a measured gas on surfaces of said electrodes through a signal line connected to said electrodes, said device comprising:

test signal inputting processing mechanism for temporarily inputting a test signal including an alternating-current component through said signal line with respect to a cell undergoing abnormality detection;

response signal detector for, in response to the inputting of said test signal, detecting a response signal developing in said signal line;

impedance calculator for obtaining an impedance between said electrodes on the basis of said test signal and said response signal;

decision processing mechanism for comparing the obtained impedance value with a prescribed value and, if the obtained impedance value exceeds said prescribed value, making a decision that a disconnection abnormality occurs in said undergoing abnormality detection;

~~The device according to claim 10, further comprising:~~

~~temperature state detecting means~~detector for detecting a temperature state of said solid electrolyte material; and

~~inhibiting means~~processing mechanism for inhibiting the abnormality decision processing in said decision ~~means~~processing mechanism until said temperature state reaches a predetermined temperature region of said solid electrolyte material.

12. (currently amended) The device according to claim 11, wherein said temperature state ~~detecting means~~detector obtains an energizing time

with respect to a heater integrated with said gas sensor together with said cell, with said energizing time being used as a parameter for said temperature state.

13. (currently amended) The device according to claim 11, wherein said temperature state ~~detecting means~~ detector obtains a total applied electric energy to a heater integrated with said gas sensor together with said cell, with said total applied electric energy being used as a parameter for said temperature state.

14. (currently amended) A gas sensor abnormality detecting device made to detect the presence or absence of abnormality of a gas sensor having a cell in which a pair of electrodes are formed on a solid electrolyte material to output a signal corresponding to a composition of a measured gas on surfaces of said electrodes through a signal line connected to said electrodes, said device comprising:

signal inputting processing mechanism for temporarily inputting a test signal including an alternating-current component through said signal line to said cell undergoing abnormality detection;

response signal detector for detecting a response signal developing in said signal line in response to the inputting of said test signal; and

decision processing mechanism for comparing a detection value of said response signal with a prescribed value and, if said detection value resides in one of regions defined by said prescribed value, making a decision that a disconnection abnormality occurs in said cell undergoing the abnormality detection;

~~The device according to claim 1,~~ wherein said test signal inputting ~~means~~ processing mechanism constitutes a power supply of said cell and temporarily inputs one of a voltage variation and a current variation to said signal line, and said response signal ~~detecting means~~ detector detects one of a variation of a current flowing through said signal line and a variation of a voltage between said electrodes as said response signal.

15. (currently amended) The device according to claim 14, wherein said test signal inputting ~~means~~ processing mechanism inputs one of a voltage and a current varying in both a positive and negative directions with respect to one of a voltage and a current immediately before.

16. (currently amended) The device according to claim 14, wherein said test signal inputting ~~means~~ processing mechanism inputs one of a voltage and a current varying in one of a positive and negative directions with respect to one of a voltage and a current immediately before.